APPENDIX F

MANUFACTURING DATA COLLECTION QUESTIONNAIRE

this page intentionally left blank

DESIGN FOR THE ENVIRONMENT COMPUTER DISPLAY PROJECT
Life-Cycle Inventory (LCI) Data Collection Questionnaire

Introduction
The Design for the Environment (DfE) Program in the U.S. Environmental Protection Agency's (EPA) Office of Pollution Prevention and Toxics has begun a voluntary, cooperative project with the electronics industry to assess the life-cycle environmental impacts of cathode ray tube (CRT) and liquid crystal display (LCD) desktop monitors. The DfE Program conducts comparative analyses of alternative products or processes to provide businesses with data to make environmentally informed choices about product or process improvements. The DfE Program has no regulatory or enforcement agenda and was established to act as a partner with industry to promote pollution prevention. This environmental life-cycle assessment will address human and ecological risk, energy and natural resource use, performance, and cost of various display technologies. The University of Tennessee (UT) Center for Clean Products and Clean Technologies is conducting the life-cycle inventory (LCI), which is the data collection phase of a life-cycle assessment, with technical assistance from the Asian Technology Information Program, Microelectronics and Computer Technology Corporation, the Electronics Industry Alliance, and other partners.

Boundaries
A *life-cycle* assessment considers impacts from materials acquisition, material manufacturing, product manufacturing, use, and final disposition of a product. The LCI data are intended to be used to evaluate relative environmental impacts over the entire life-cycle of a product, including transport between life-cycle stages. In this project, the product is either a color CRT or LCD monitor. Therefore, data associated with the materials and processes used directly in the manufacturing, use, and disposition of the product are relevant to the LCI and requested in this questionnaire. You will not need to include materials or energy *not directly* used in the production of the monitor or its components (e.g., general building heating and air conditioning).

Product focus
This project will evaluate CRT and LCD (twisted nematic and in-plane switching) technologies, based on 1998 production for a 17" CRT and a 15" LCD desktop monitor, with the following approximate specifications:

1024×768 resolution	200 cd/m^2 brightness
100:1 contrast ratio	262,000 colors

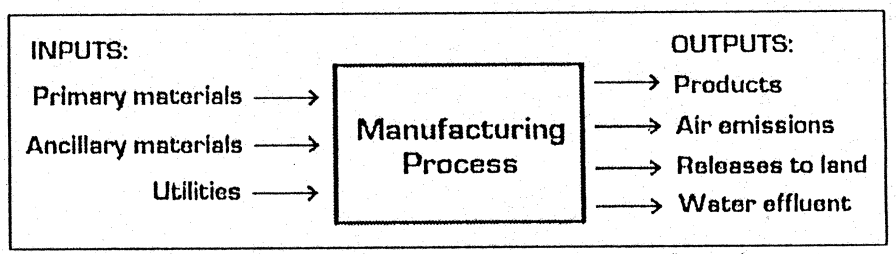

Fig. 1. Manufacturing process inventory conceptual template

Inventory data
We are asking you for data on a particular "product of interest" that you manufacture, which is defined as a material, component, or subassembly that is part of the product focus defined above. The inputs and outputs data (Fig. 1) that you provide will be aggregated in the LCI to quantify the overall inputs and outputs of a CRT and LCD. Additionally, transportation information is requested in the inventory.

Data sources
Much of the requested information can be drawn from existing sources, including, but not limited to the following:

1. Purchase and production records
2. Bills and invoices
3. Material Safety Data Sheets (MSDS)
4. Toxic Release Inventory (TRI) forms
5. Audit and analysis results (e.g., wastewater discharge analyses)
6. Local, state, and federal reporting forms (e.g., hazardous waste manifests)
7. Local, state, and federal permits
8. Monthly utility billing records

How the data will be used
UT will aggregate the inventory data and tally the average inputs and outputs for the different monitors. Information gathered by this questionnaire will be used to develop environmental profiles based on inputs and outputs for each stage in the manufacture of displays. The profiles will be used to evaluate environmental impacts from each product. Cost data will also be collected and presented along with environmental results. The environmental profiles can be used to encourage product design changes for product improvement. UT will aggregate data and ensure that data associated with particular companies remain anonymous to the EPA. UT can enter into confidentiality agreements where proprietary data are concerned. Please understand that accurate and representative information from you is critical for the success of this project.

Results of project
The results are intended to provide industry with an analysis of the life-cycle environmental impacts, cost, and performance of CRT and LCD computer monitors. Results will help identify areas for product and process improvement as related to risk and environmental impact (e.g., identifying material use inefficiencies) and will identify impacts from various life-cycle stages of the product systems. Use of the results will also help meet growing global demands of extended product responsibility.

Benefits of involvement
Your input will allow for your interests to be considered in the project development and data collection. By supplying data, the results will partially reflect your operations and, therefore, the results will be directly relevant to your interests. The project will allow you to directly apply results to your manufacturing process and identify areas for improvement. You will also be recognized as working voluntarily and cooperatively with the U.S. EPA.

Deadline
We are attempting to obtain all completed questionnaires before ***October 29, 1999***.

Your cooperation and assistance are greatly appreciated.

*For any questions, please contact **Maria Leet Socolof at 423-974-9526, <socolofml@utk.edu> or Jonathan G. Overly at 423-974-3625, <jgoverly@utk.edu> at the University of Tennessee, 311 Conference Center Bldg., Knoxville, TN 37996-4134. Fax: 423-974-1838.***
For more project details, see the Project Fact Sheet, DfE Website <www.epa.gov/dfe>, or the Draft Final Goal Definition and Scoping Document.

INSTRUCTIONS

1. Please be sure to read the introductory text on each page before filling out the questionnaire.
2. The data you supply in the tables should represent inputs and outputs associated only with the **"product of interest" (i.e., materials, components or subassemblies you manufacture that are either part of, or that are itself, the desktop monitor as defined on p. i under Product focus)**. If quantities provided are not specific to the "product of interest," please explain how they differ in the comments section at the bottom of the appropriate table.
3. Where supporting information is available as independent documents, reports or calculations, please provide them as attachments with reference to the associated page(s) or table(s) in this questionnaire.
4. If you have more than one product of interest to this project, please duplicate this questionnaire and fill out one questionnaire for each product.
5. If there is not adequate room on a page to supply your data (including comments), please copy the appropriate page and attach it to this packet.
6. The ensuing pages refer to the four indices shown below to detail specific information about the data. Additional information is provided below as required.
   Data Quality Indicators Index: These indicators will be used to assess the level of data quality in this questionnaire. Please report a DQI for the numerical value requested in each table on the following pages. The first category, Measured, pertains to a value that is a directly measured quantity. The second category, Calculated, refers to a value that required one or more calculations to obtain. The third category, Estimated, refers to a value that required a knowledgable employee's professional judgement to estimate. Lastly, the fourth category, Assumed, should be used only when a number had to be guessed.
   Hazardous and Nonhazardous Waste Management Methods Index: These methods are applicable to both hazardous and nonhazardous wastes (Tables 7a and 7b). Please give the appropriate abbreviation in the Management Method column on p. 7 where requested. Depending on whether the management method is on or offsite, please indicate by specifying "on" or "off" in the appropriate column on p. 7.

For Tables 2, 3a, 3b, 4, 7a, and 7b:

Transportation Modes Index	
A	- Large truck (18-wheeler), diesel
B	- Small truck, diesel
C	- Small truck, gasoline
D	- Rail, diesel
E	- Barge, diesel
F	- Ocean freighter, diesel
G	- Other (please specify in comments section)

For Table 6b:

Wastewater Treatment/Disposal Methods Index	
A	- Direct discharge to surface water
B	- Discharge to offsite wastewater treatment facility
C	- Underground injection
D	- Surface impoundment (e.g., settling pond)
E	- Direct discharge to land
F	- Other (please specify in comments section)

For Tables 3a, 3b, 4, 5, 6a, 7a, and 7b:

Data Quality Indicators Index	
M	- Measured
C	- Calculated
E	- Estimated
A	- Assumed

For Tables 7a and 7b:

Hazardous and Nonhazardous Waste Management Methods Index	
RU	- Reused
R	- Recycled
L	- Landfilled
Iv	- Incinerated - volume reduction
Ie	- Incinerated - energy conversion
S	- Solidified/stabilized
D	- Deep well injected
O	- Other (please specify in comments section)

IF YOU HAVE QUESTIONS, PLEASE CONTACT EITHER:

Maria L. Socolof (Project Manager): Phone: 423-974-9526, Fax: 423-974-1838, Email: socolofml@utk.edu

OR

Jonathan G. Overly (Project Engineer): Phone: 423-974-3625, Fax: 423-974-1838, Email: jgoverly@utk.edu

OFFICE OF MANAGEMENT AND BUDGET STATEMENT

The public reporting and recordkeeping burden for this collection of information is estimated to average 8 hours per response. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. The burden for this collection includes the time needed to review instructions; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information. An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. The OMB control number for this collection is 2070-0152.

Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, OPPE Regulatory Information Division, U.S. Environmental Protection Agency (2136), 401 M Street, S.W., Washington, DC 20460. Include the OMB control number in any correspondence.

1. FACILITY & CONTACT INFORMATION

Table 1.	Facility Information	Contact Information	
1. Company name:		5a. Prepared by:	Date:
2. Facility name:		5b. Title:	
3. Facility address (location):		5c. Phone number:	Ext.:
		5d. Fax number:	
		5e. Email address:	
4. Products manufactured onsite:			

2. PRODUCT OF INTEREST INFORMATION

Table 2.

NOTE: If the product of interest is an assembled monitor, please send an Owner's Manual to us at the address shown at the bottom of page ii.

1. Product of interest: _____

2. 1998 annual production (e.g., units, kg, lbs): _____

3. Facility's percent global market share for product of interest: _____

4. Product of interest unit weight: _____

5. 1998 product of interest retail unit price: _____

6. Energy consumption information (fill out only if the product of interest is an assembled monitor):
   - Active use: _____ watts
   - Standby: _____ watts
   - Suspend: _____ watts
   - Active off: _____ watts

7. Performance specifications (fill out only if the product of interest is an assembled monitor):
   - Maximum resolution: _____
   - Colors (at max. reso.): _____
   - Contrast ratio: _____
   - Brightness: _____ cd/m²

8. Brief description of the main operations/subprocesses required to manufacture the product of interest: _____

9. Product transport information. In this table, please list the top five locations (by quantity) to which you send the product of interest. You may supply one-way distances in lieu of locations. See Transportation Modes Index on p. iii for modes abbreviations. Percent capacity represents what percent of the transport vehicle's total load was carrying the products of interest.

	Location (City, State, Country)	Distance	Percent of production	Mode	Number of trips annually	Percent capacity
1)						
2)						
3)						
4)						
5)						

10. Does your facility receive any returned products from your customers? If so, is the product recycled in some way or disposed? Please explain: _____

3. PRIMARY & ANCILLARY INPUTS

1. Primary & Ancillary Materials: Primary materials, are defined as those materials that become part of the final product. Ancillary materials are those material inputs that assist production, yet do not become part of the final product. Please include the trade name and the generic name of each material where applicable.
2. CAS # or MSDS: Please either supply the chemical CAS (Chemical Abstract Service) number or attach a material "MSDS" to this document.
3. Annual quantity/units & Density/units: Please specify the amount of material consumed in 1998. Please use the units of mass-per-year (e.g., kg/yr, lb/yr). If you specify units of volume in lieu of mass, please provide the density.
4. Data quality indicators: See the Data Quality Indicators Index on p. iii for abbreviations. Please supply the DQI for the *annual quantity* value given.
5. Recycled content: Please specify the recycled content of each material identified. For example, 60/40/0 would represent a material that has 60% virgin material, 40% pre-consumer recycled and 0% post-consumer recycled content. Enter N/A (not applicable) for all components that are assemblies.
6. Transportation information: See the Transportation Modes Index on p. iii for mode abbreviations. Please specify the one-way transportation distance, or the location from where the material is shipped, and the number of trips made to your facility on an annual basis. % capacity represents what percent of the transport vehicle's total *load* was carrying the materials of interest.

Table 3a. Primary Materials[1]	CAS # or MSDS[2]	Annual Quantity[3]	Units	Density[3]	Units	DQI[4]	Recycled Content[5]	Transportation Information (Receiving)[6]			
								Dist. or Location	Mode	# trips	% cap.
EXAMPLE: 'GRTX resin (polypropylene resin)	*MSDS*	*450,000*	*kg/yr*	*-----*	*---*	*M*	*60/40/0*	*450 km*	*A*	*24*	*40*
1.											
2.											
3.											
4.											
5.											
6.											
7.											

Primary material comments:

Table 3b. Ancillary Materials[1]	CAS # or MSDS[2]	Annual Quantity[3]	Units	Density[3]	Units	DQI[4]	Recycled Content[5]	Transportation Information (Receiving)[6]			
								Dist. or Location	Mode	# trips	% cap.
EXAMPLE: Petroleum naphtha (cleaning solvent)	*8032-32-4*	*920*	*liters/yr*	*0.96*	*kg/liter*	*C*	*100/0/0*	*St. Louis, MO*	*C*	*2*	*100*
1.											
2.											
3.											
4.											
5.											
6.											
7.											

Ancillary material comments:

4. UTILITY INPUTS

1. Annual quantity/units: Please specify the amount of each utility consumed in 1998. If possible, please exclude nonprocess-related consumption. If not possible, please include a comment that nonprocess-related consumption is included.
2. Data quality indicators: See the Data Quality Indicators Index on p. iii for abbreviations. Please supply the DQI for the *annual quantity* value given.
3. Transportation information: See the Transportation Modes Index on p. iii for mode abbreviations. Please specify the one-way transportation distance, or the location from where the fuel is shipped, and the number of trips made to your facility on an annual basis. % capacity represents what percent of the transport vehicle's total *load* was carrying the materials of interest.
4. Individual Utility Notes:

Electricity:
The quantity of electricity should reflect only that used toward manufacturing the product of interest (identified on p. 2). One approach would be to start with your facility's total annual electrical energy consumption, estimate and remove nonprocess-related consumption, then estimate what portion of the remaining consumption is related to the specific operations of interest (if you manufacture more than one product). Please include consumption in all systems that use electricity for process-related purposes. Some examples include compressed air, chilled water, water deionization and HVAC consumption where clean or controlled environments are utilized.

Natural gas and LNG:
Please exclude all use for space heating or other nonprocess-related uses. If you choose to use units other than MCF (thousand cubic feet), please utilize only units of energy content or volume (e.g., mmBTU, therm, CCF).

Fuel oils:
Please use units of either volume or energy content (e.g., liters, cubic meters, mmBTU, MJ). Additionally, if the fuel oil is delivered by pipeline, enter "pipeline" in the Transportation Information space; if not delivered by pipeline, please include the associated transportation information.

All waters (e.g., deionized, city):
Please include all waters received onsite. Please indicate consumption in units of mass or volume.

Table 4. Utilities[4]	Annual Quantity[1]	Units	DQI[2]	Transportation Information (Receiving)[3]			
				Dist. or Location	Mode	# trips	% cap.
1. Electricity		MJ					
2. Natural gas		MCF					
3. Liquified natural gas (LNG)		MCF					
4. Fuel oil - type #2 (includes distillate and diesel)		liters					
5. Fuel oil - type #4		liters					
6. Fuel oil - type #6 (includes residual)		liters					
7. Propane		liters					
8. Water		liters					
9.							
10.							
11.							
12.							
13.							

Utility comments:

5. AIR EMISSIONS

1. Air emissions: The emissions listed in the table below are some of the more common ones found in air release inventories; if you have information on other specific emissions, please include that information in the space provided. If you have any reporting forms or other air emission records for 1998, please attach copies to this questionnaire. Also, if you have information on stack as well as fugitive emissions, please copy this page and place each set of emissions on a different page. The energy consumed in any equipment used onsite to treat air emissions should be included in the utilities values on p. 4.
2. Annual quantity/units: Please specify the amount of air emissions generated in 1998. If you do not have 1998 emissions data, use the next closest year's data you have and specify what year's data you are supplying in the comment section below. Please use units of mass-per-year (e.g., kg/yr, lb/yr).
3. Data quality indicators: See the Data Quality Indicators Index on p. iii for abbreviations. Please supply the DQI for the *annual quantity* value given.

Table 5. Air Emissions[1]	CAS number	Annual Quantity[2]	Units	DQI [3]
Total particulates	-----			
Particulates < 10 microns (PM-10)	-----			
Sulfur oxides (SOx)	-----			
Nitrogen oxides (NOx)	-----			
Carbon monoxide	630-08-0			
Carbon dioxide	124-38-9			
Methane	74-82-8			
Benzene	71-43-2			
Toluene	108-88-3			
Xylenes	1330-20-7			
Naphthalene	91-20-3			
Total nonmethane VOCs	-----			
Other speciated hydrocarbon emissions:				
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				

Table 5 (continued). Air Emissions[1]	CAS number	Annual Quantity[2]	Units	DQI [3]
Ammonia	7664-41-7			
Arsenic	7440-38-2			
Chromium	7440-47-3			
Copper	7440-50-8			
Lead	7439-92-1			
Manganese	7439-96-5			
Mercury	7439-98-7			
Nickel	7440-02-0			
Other emissions:				
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Air emission comments:

6. WASTEWATER RELEASES & CONSTITUENTS

1. Annual quantity/units: Please specify the amount of wastewater(s) generated in 1998. Please use units of mass-per-year (e.g., kg/yr, lb/yr). If multiple streams exist, please copy this page and fill it out for each stream.
2. Data quality indicators: See the Data Quality Indicators Index on p. iii for abbreviations. Please include one DQI for the annual wastewater stream quantity value supplied, and one DQI for the wastewater constituents information supplied. If more than one DQI is applicable to the wastewater constituents data, please clarify this in the comment section.
3. Wastewater constituents: Please let us know what type of values you are supplying (e.g., daily maximums, monthly averages, annual averages). Additionally, if you have any reporting forms of other wastewater constituent records for the 1998, please attach them to this questionnaire. The energy consumed in any equipment used onsite to treat wastewater releases should be included in the utilities values on p. 4.
4. Concentration/units: Please specify the concentration of wastewater constituents generated in 1998. Please utilize the units of mass-per-volume (e.g., mg/liter, lb/gal).
5. Wastewater treatment/disposal (WW T/D) method: See the Wastewater Treatment/Disposal Methods Index on p. iii for method abbreviations.

Table 6a. Wastewater Stream	Annual Quantity[1]	Units	DQI for Wastewater Annual Quantity[2]	DQI for Wastewater Constituents[2]

Table 6b. Wastewater Constituents[3]	CAS number	Concentration[4]	Units	WW T/D Method[5]
Dissolved solids	-----			
Suspended solids	-----			
Chemical Oxygen Demand (COD)	-----			
Biological Oxygen Demand (BOD)	-----			
Oil & grease	-----			
Hydrochloric acid	7647-01-0			
Sulfuric acid	7664-93-9			
Other acids (please specify):				
1.				
2.				
Phosphorus	7723-14-0			
Phosphates	-----			
Sulfates	-----			
Fluorides	-----			
Cyanide	-----			
Chloride	-----			
Chromium	7440-47-3			
Iron	7439-89-6			
Aluminum	7429-90-5			
Nickel	7440-02-0			

Table 6b (continued). Wastewater Constituents[3]	CAS number	Concentration[4]	Units	WW T/D Method[5]
Mercury	7439-98-7			
Lead	7439-92-1			
Nitrogen	7727-37-9			
Zinc	7440-66-6			
Tin	7440-31-5			
Ferrous sulfate	7720-78-7			
Ammonia	7664-41-7			
Nitrates	-----			
Pesticides	-----			
Other constituents:				
1.				
2.				
3.				
4.				
5.				
6.				

Wastewater comments:

7. HAZARDOUS & NONHAZARDOUS WASTES

1. Hazardous wastes and EPA hazardous waste numbers: Please list your waste streams that are considered hazardous by the U.S. EPA. Include the hazardous waste codes for any hazardous waste you include.
2. Annual quantity/units & Density/units: Please specify the amount of waste generated in 1998. Use units of mass-per-year (e.g., kg/yr, lb/yr). Please also provide the density for each waste.
3. Data quality indicators: See the Data Quality Indicators Index on p. iii for abbreviations. Please supply the DQI for the *annual quantity* value given.
4. Management method: See the Management Methods Index on p. iii for abbreviations. If none are applicable, please indicate other and use the comments section to expound.
5. Transportation information: See the Transportation Modes Index on p. iii for mode abbreviations. Please specify the one-way transportation distance, or the location to where the waste is shipped, and the number of trips made from your facility on an annual basis. % capacity represents what percent of the transport vehicle's total *load* was carrying the wastes of interest.

Table 7a. Hazardous Wastes[1]	EPA Haz. Waste #[1]	Annual Quantity[2]	Units	Density[2]	Units	DQI [3]	Mgmt. method[4]	On or offsite?	Transportation Information (Shipping)[5] Dist. or Location	Mode	# trips	% cap.
EXAMPLE: Spent solvent (toluene)	*F005*	*20,000*	*kg/yr*	*0.9*	*kg/liter*	*M*	*Ie*	*off*	*Indianapolis, IN*	*A*	*24*	*40*
1.												
2.												
3.												
4.												
5.												
6.												
7.												
8.												

Hazardous waste comments:

Table 7b. Nonhazardous Wastes	Annual Quantity[2]	Units	Density[2]	Units	DQI [3]	Mgmt. method[4]	On or offsite?	Transportation Information (Shipping)[5] Dist. or Location	Mode	# trips	% cap.
EXAMPLE: Waste metal chips	*22,000*	*kg/yr*	*1,000*	*kg/m3*	*C*	*R*	*off*	*225 km*	*A*	*2*	*100*
1.											
2.											
3.											
4.											
5.											
6.											
7.											

Nonhazardous waste comments: